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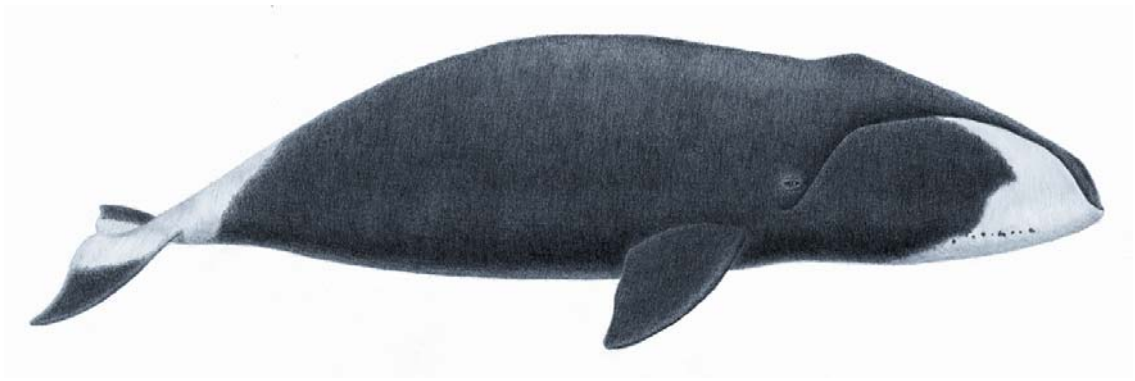
Conservation Strategy
for

BOWHEAD WHALES

(Balaena mysticetus)

in the Eastern Canadian Arctic



Recovery of Nationally Endangered Wildlife

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Conservation Strategy for BOWHEAD WHALES *(Balaena mysticetus)* in the Eastern Canadian Arctic[1]

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on behalf of the

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[1] This document will form the basis of a Recovery Strategy under the Species At Risk Act.

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Members of the Advisory Committee – Joanasie Akumalik, Susan Cosens, Peter Ewins, Ben Kovic, John Laird, Patrice Simon and Michelle Wheatley – provided information, advice and review, and guided the process. The workshop participants and stakeholders are thanked for their contribution of knowledge and experiences, and for making the workshop a success. Special thanks to the three regional wildlife organizations – Keewatin Wildlife Federation, Kitikmeot Hunters and Trappers Association, and Qikiqtaaluk Wildlife Board – for their assistance in bringing elder hunters to the workshop. NWMB and all the elders are thanked for the documentation of traditional knowledge on bowheads.

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The Nunavut Wildlife Management Board staff, especially Evie Amagoalik, translated earlier versions of this Conservation Strategy into Inuktitut. Jonah Kilabuk and Mary Nashook translated the final version of the Strategy into Inuktitut, and Allset Inc. translated the document into French. Charles Moody edited the Strategy. All of their efforts are greatly appreciated.

Dedication

This Conservation Strategy is dedicated to the Inuit elders and hunters who contributed their knowledge and experiences to the Inuit Bowhead Knowledge Study and to this Conservation Strategy.

This Strategy is also dedicated to Dr. Stu Innes, a marine mammal research scientist with the Department of Fisheries and Oceans. Stu and a colleague, Dr. Malcom Ramsay, a well known polar bear scientist from the University of Saskatchewan, both died in a tragic helicopter accident on 21 May, 2000, while conducting research in the high Arctic. Stu worked closely with Inuit hunters and was totally committed to his research supporting the better management of marine mammals. He was an advisor to the Inuit Bowhead Knowledge Study and took the lead role in estimating sustainable harvest levels for bowheads in the Canadian eastern Arctic.

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Executive Summary

1. The bowhead or Greenland right whale (*Balaena mysticetus),* called *arvik* or *arviq* in Inuktitut, has been used for at least 2,000 years by Inuit for food, oil, and shelter, and is an important part of Inuit culture.

2. Inuit hunted bowheads for a long time without having a significant impact on the populations. Commercial whaling, which occurred up to the early to mid 20th century, depleted all of the world's five bowhead whale populations, including those in the Canadian eastern Arctic.

3. There are two populations of bowhead whales in the Canadian eastern Arctic. The Hudson Bay-Foxe Basin bowheads appear to occur only in Nunavut waters. The Baffin Bay-Davis Strait whales are found both in Nunavut and Greenland waters.

4. The recovery of these populations from depletion by commercial whaling has been perceived to be slow, but on a bowhead time scale it may be occurring at a reasonable rate. Relatively low reproductive rates, together with killer whale predation, other sources of natural mortality, and low-level subsistence hunting may prevent a faster recovery, especially from critically low population levels.

5. The Nunavut Wildlife Management Board (NWMB) recently completed a five-year Inuit Bowhead Knowledge Study (IBKS) documenting Inuit traditional knowledge of sightings, locations, movements and aggregations of bowheads throughout the Nunavut Settlement Area. Many Inuit concluded that bowhead populations have increased in numbers in the last few decades but also believe that predation by killer whales and factors such as noise from exploratory and industrial development may be reducing recovery rates.

6. In the Inuit Bowhead Knowledge Study, Inuit emphasize that harvesting bowhead is important for retaining their culture. Many Inuit believe, as indicated in the study, that a low-level subsistence hunt would not jeopardize continued recovery of the two bowhead populations in Nunavut. They also state that the bowhead whales should be carefully and properly managed and that future harvests should be strictly controlled, monitored and managed.

7. The Hudson Bay-Foxe Basin and Baffin Bay-Davis Strait bowheads have been designated as separate populations based on summer distribution patterns and responses to whaling pressure. The Hudson Bay-Foxe Basin Stock has been estimated to have numbered at least 600 whales prior to heavy exploitation in the period 1860-1915. Based on recent aerial surveys, an estimate of 345 bowheads represents the minimum number thought to be present in this population. Many Inuit say that bowhead numbers in Northern Foxe Basin and in the Repulse Bay area are higher today than in the 1960s and 1970s. These comments come from elders and hunters who infrequently saw bowheads until recently. The Baffin Bay-Davis Strait Stock likely numbered around 12,000 individuals in the year 1825. Counts and estimates

during the 1970s and 1980s produced minimum estimates of 350 to 375 bowheads. As in the Hudson Bay-Foxe Basin population, many Inuit say that when they were children or young adults, they rarely saw bowheads or saw only small numbers but in recent years they have been seeing greater numbers.

8. In the spring of 1999, the Nunavut Wildlife Management Board (NWMB), World Wildlife Fund Canada (WWF), and the Department of Fisheries and Oceans (DFO) agreed to jointly develop a long-term Conservation Strategy that would include a strategy and outline actions to promote recovery of bowhead populations in the Canadian eastern Arctic. The partners also agreed to incorporate traditional knowledge from the Inuit Bowhead Knowledge Study (IBKS) to complement the scientific knowledge.

9. An internal Advisory Committee (essentially a "Recovery Team"), consisting of members from the three partners and the Qikiqtaaluk Wildlife Board (QWB), was established to guide the development of this conservation strategy. Robert Moshenko, an experienced Arctic marine biologist and resource manager, was contracted to facilitate the process. This Advisory Committee could be the basis for the Recovery Implementation Team that would be established and provide the forum for review and planning of actions to promote recovery and conservation of bowheads in Nunavut.

10. A workshop was held in Iqaluit on 16-17 December 1999. It provided the opportunity for all major stakeholders in Nunavut to participate in the development of a long-term conservation strategy for bowhead whale populations. The stakeholders participated through group discussions. They developed the mission statement, goals and objectives (actions) for the overall management (recovery, sustainable subsistence harvest, and habitat protection) of the bowhead whale populations. They also identified and rated potential long-term threats to bowheads and their habitat. The major threats identified were killer whales, pollution, man-made noise, tourism, climate change, and non-harvesting. Lesser threats that were identified included ice entrapments, fishing gear entrapment, subsistence harvest, diseases and food competition.

11. Bowhead whales may live as long as 200 years so an effective conservation strategy, recovery program and monitoring program must be long-term to reflect the bowhead lifespan. This long-term recovery strategy for the bowhead whale populations in the Canadian eastern Arctic, with a recommended time-frame of 100 years, was developed by the internal Advisory Committee for the lead agencies, i.e., the Department of Fisheries and Oceans and the Nunavut Wildlife Management Board and its partners.

12. The Conservation Strategy provides a framework to identify information gaps and to develop and implement programs to research and monitor bowhead population levels, and threats to bowhead and their habitat that may impede recovery. These programs would integrate Inuit traditional knowledge and science, and would be community-

based. To be successful, this long-term strategy requires a strong commitment from the lead agencies and partners to sustain focus, funding and overall momentum.

13. This Conservation Strategy has been developed in anticipation of the new federal *Species at Risk Act (SARA)*, and may meet the requirements for or will form the basis of a recovery strategy. The format used follows the guidelines drafted in February 2000 to be used in developing a recovery strategy under SARA.

14. The purpose of this Conservation Strategy is to improve the conservation status of bowhead whales in the Canadian eastern Arctic by:

- using an ecosystem approach and focusing on long-term key conservation issues,
- identifying current major information gaps and actions needed to fill the gaps,
- providing a conservation strategy that may meet the requirements for or will form the basis of a recovery strategy under the Species at Risk Act.

The **recovery goal** is to promote population recovery and maintain self-sustaining and healthy bowhead whale populations in Nunavut.

The **short-term objectives** are to:

- identify and protect important areas used by bowhead whales,
- establish a long-term monitoring and research program combining both traditional knowledge and science,
- ensure a sound, sustainable and continuing Inuit subsistence harvest of bowhead whales,
- ensure that any human activities do not adversely affect bowhead whale populations or their habitat,
- communicate clearly this conservation initiative to the public in Nunavut and beyond.

I. INTRODUCTION

The Bowhead or Greenland Right Whale (*Balaena mysticetus),* called *arvik* or *arviq* in Inuktitut, has been known and used for at least 2,000 years by indigenous peoples for food, oil, shelter, and other products (Stoker and Krupnik 1993; NWMB 2000). Freeman *et al*. (1998) note that harvesting of whales also serves to link Inuit symbolically and spiritually to their cultural heritage. Commercial whaling up to the early to mid 20th century depleted all of the world's five bowhead whale stocks or populations, especially those in the Canadian eastern Arctic (Mitchell and Reeves 1982). Inuit are aware that their ancestors had hunted bowheads for a long time without affecting the populations and that the *Qallunat* (people of European origin) commercial whalers had depleted the population by the early 20th century. They wish to emphasize that Inuit were not responsible for over-harvesting (NWMB 2000). After the end of commercial whaling, the Inuit use of bowhead was sporadic, and ceased altogether on the institution of the restrictions on subsistence hunting in 1979 (NWMB 2000). Since the end of commercial whaling, the recovery of these populations has been perceived to be slow, but in a bowhead time scale it may be occurring at a reasonable rate. The Inuit Bowhead Knowledge Study (IBKS)(NWMB 2000) states that recovery could be adversely affected by factors such as contaminants (local and global), motorized boat traffic, and predation by killer whales (*aarluit*).

In the Nunavut Territory, especially in recent years during negotiation of the Nunavut Land Claims Agreement (NLCA) in 1993 (Appendix 1), many Inuit expressed a desire to re-establish their important cultural and subsistence link to the bowhead by resuming hunting. As part of the agreement, the Nunavut Wildlife Management Board (NWMB) recently completed the Inuit Bowhead Knowledge Study on sightings, locations and aggregations of bowheads in the Nunavut Settlement Area (NWMB 2000). A bowhead was harvested under approval of the Nunavut Wildlife Management Board and license of the federal Minister of Fisheries and Oceans in 1996, 1998 and 2000. These hunts have sparked some intense international debate as to whether the eastern Arctic populations have recovered enough to resume and sustain any level of subsistence hunt.

In the spring of 1999, the Nunavut Wildlife Management Board (NWMB), World Wildlife Fund Canada (WWF), and the federal Department of Fisheries and Oceans (DFO) agreed to develop jointly a long-term Conservation Strategy, which would include a recovery plan and actions, for bowhead populations in the Canadian eastern Arctic (Ewins and Kovic 1999). The partners also agreed to incorporate traditional knowledge from the Inuit Bowhead Knowledge Study (Appendix 2) into this strategy to complement the scientific knowledge. An internal Advisory Committee (Appendix 3) was established to guide the development of the conservation strategy. In the future, this Advisory Committee could form the basis of the 'Recovery Team' for the implementation of this Bowhead Conservation Strategy.

A workshop was held in Iqaluit on 16-17 December 1999. It provided the opportunity for all major stakeholders in Nunavut to participate in the development of a long-term conservation strategy for bowhead whale populations. Participants were provided with a

translated (into Inuktitut) working document (earlier version of this document), prepared as background information on the scientific knowledge. The stakeholders participated through group discussions. They developed the mission statement and goals, and identified actions for the overall management, including recovery, sustainable subsistence harvest, and habitat protection, of the bowhead whale populations. They also identified and rated potential threats to bowheads (Appendix 4).

Workshop participants agreed that traditional and scientific knowledge would be given equal importance in this initiative. Traditional knowledge was incorporated into the strategy after the publication of the Inuit Bowhead Knowledge Study in March 2000. Stevenson (1996) states that traditional knowledge can inform scientific knowledge and *vice versa*.

The purpose of this Conservation Strategy is to improve the conservation status of bowhead whales in the Canadian eastern Arctic by:

- using an ecosystem approach and focusing on long-term key conservation issues,
- identifying current major information gaps and actions needed to fill the gaps,
- providing a conservation strategy that may meet the requirements for or will form the basis of a recovery strategy under the Species at Risk Act.

Recent evidence suggests that bowhead whales may live as long as 200 years of age (George *et al.* 1999). Therefore, the time frame of an effective recovery plan, recovery program, and monitoring program must reflect bowhead longevity and the expected time over which population recovery will occur. Therefore, the time frame of 100 years is recommended for the implementation of this Bowhead Conservation Strategy, with evaluation intervals of 5 – 10 years.

All bowhead whales in the Canadian Arctic were listed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1980 and again in 1986 (Appendix 5). This designation is currently under review.

This Conservation Strategy briefly outlines the history of bowhead whale-related activities in the Canadian eastern Arctic from the Inuit cultural and subsistence use to commercial whaling. It discusses the evidence for population recovery, potential major ecological threats to recovery, Inuit needs and the resumption of limited Inuit hunting, future low-level sustained subsistence hunting, and options and actions that should be taken to promote recovery of the populations. This Conservation Strategy will be used by the lead agencies and their partners to conserve and protect the bowhead populations. This document was developed in anticipation of the new federal *Species at Risk Act (SARA)*, and may meet the requirements for or will form the basis of a recovery strategy.

II. CULTURAL AND TRADITIONAL IMPORTANCE OF BOWHEAD

Inuit believe that all animals were put on earth for them to harvest and use, and they are convinced that wildlife populations will remain healthy and abundant only if they are harvested and treated with respect (NWMB 2000). The bowhead whale, an important part of the Inuit traditional way of life, has been hunted in the arctic and sub-arctic seas for at least the last 2000 years by indigenous people for food, fuel and other products. Bowhead hunting was linked to social status (Stoker and Krupnik 1993). Harvesting of whales continues to be one of the most important collective activities in many Inuit communities and serves to reinforce significant culturally established collective rights and social relationships, responsibilities, and obligations. Whale *maktak* (skin and some blubber) remains, for many Inuit, one of the most highly desired traditional foods. It is highly nutritious, rich in vitamins A and C and minerals, low in saturated fats, high in omega-3 polyunsaturated fats, and psychologically beneficial (Freeman *et al.* 1998). Severe depletion of bowhead populations has undermined the importance of these animals to Inuit subsistence and culture.

The bowhead hunt was an important part of Inuit culture and tradition, and a vital part of survival. Many Inuit feel that they would like to continue the bowhead hunt in order to preserve this aspect of Inuit culture and bring about more positive social implications for future generations (NWMB 2000). The Inuit Bowhead Knowledge Study (NWMB 2000) further states that many elders who know of or participated in bowhead whaling of the past crave to eat bowhead *maktak* once again. Satisfying the wishes of the elders is a means of showing respect and affection to the elders in a society whose values and activities have changed greatly in recent decades. The study notes that, today, new materials and technology have reduced the need for the bones, blubber and baleen but that future harvests would provide Inuit with a highly valued source of country food.

III. BACKGROUND

The bowhead is one of the world's ten species of baleen whales. It is distinguished from toothed whales by having baleen or keratin plates (up to 4 m in length) instead of teeth. This stout-bodied, black and white whale has thick blubber and lacks a dorsal fin or hump. Its large head occupies as much as two-fifths of the total body length and its girth (circumference) in adults can be as much as two-thirds of total body length. Large individuals can be over 20 m long (Nerini *et al*. 1984) and weigh up to 100 tonnes (DFO 1991). These slow swimming and very vocal and gregarious whales undertake extensive seasonal migrations in relation to ice conditions and food availability. Their diet consists largely of small invertebrates (zooplankton) occurring in dense swarms at the water surface, in the water column, or near the bottom. Zooplankton, consisting mainly of copepods, is strained from seawater with the baleen plates.

Traditionally, Inuit hunters recognize bowheads of two types with respect to ease or difficulty of hunting. The aggressive and retaliatory, likely younger bowhead (*arviqununngittut*) have a high, pointed and prominent protuberance of the blowhole area, and are difficult or dangerous to hunt, while the more docile, likely older whales (*arviqunuqtut*), with a more flattened blowhole area, are easier or less dangerous to hunt (NWMB 2000).

1. Species Information

Scientific Name: *Balaena mysticetus*
Common Name: bowhead whale, Greenland right whale, *arvik* or *arviq* in Inuktitut
Current COSEWIC (Committee on the Status of Endangered Wildlife in Canada) Status & Year of Designation: All Canadian populations were designated as Endangered in 1980, the population in the Beaufort Sea was reviewed in 1986, and the Canadian eastern Arctic populations are currently under review by COSEWIC.
Range in Canada: Canadian eastern Arctic marine waters (see Figs. 1 and 2).
Rationale for Status: Population numbers were severely depleted by commercial whaling that occurred until the early 1900s. Recovery has been slow because of low reproductive rates and sources of natural mortality such as predation by killer whales and occasional Inuit harvest. Recent Inuit knowledge suggests that these whales are increasing in abundance but scientific information is not available to complement this observation.

2. Current Distribution and Abundance

2.1 Canadian Eastern Arctic

The term population is generally used to mean a group of animals belonging to the same species that exchange genetic material within the group and do not exchange genetic material with adjacent groups of the species. For bowheads in the Canadian

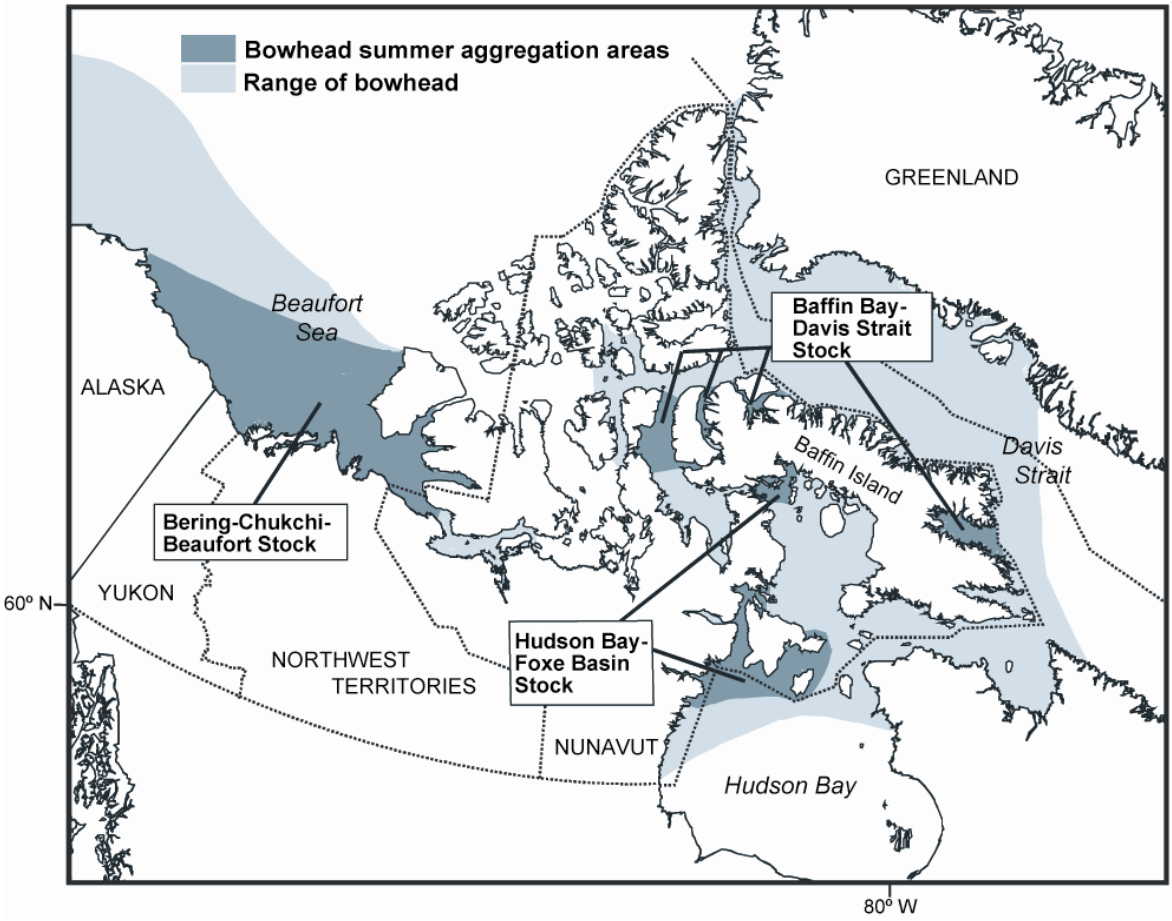

Figure 1. Ranges and summer aggregation areas of the three stocks of bowhead whales in Canadian waters

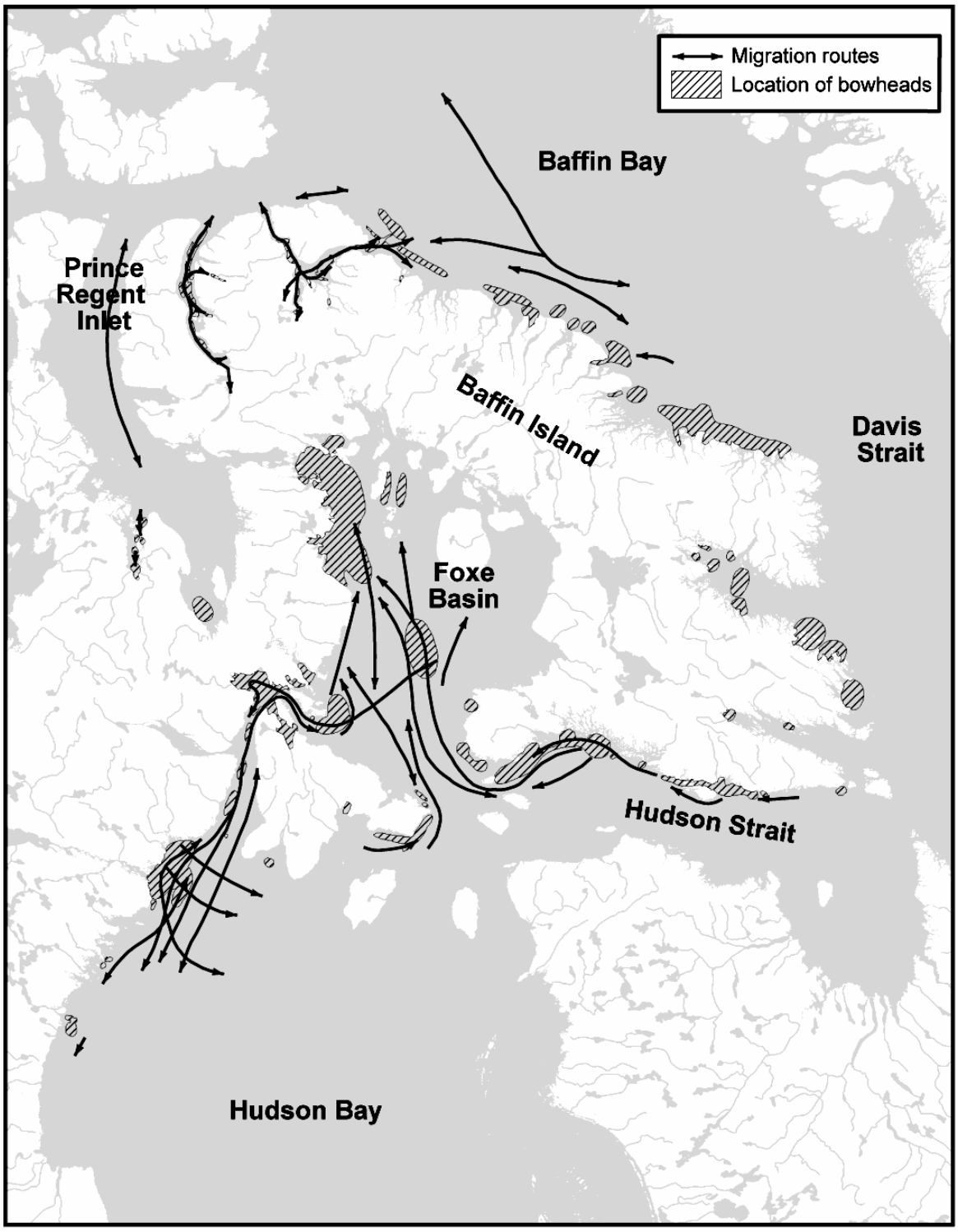

Figure 2. Distribution of bowhead whales during summer (*aujaq*), based on sightings by Inuit hunters and elders (from NWMB 2000)

eastern arctic there is some evidence to show that there are at least two populations. For discussion in this Conservation Strategy, the terms stock and population are used interchangeably (S. Cosens, pers. comm.).

In eastern Canada (see Figure 3 for place names used in this plan), bowhead whales migrate between wintering areas (where breeding likely occurs) and summering areas. Based on summer distribution patterns and migration routes, the Hudson Bay-Foxe Basin and Baffin Bay-Davis Strait bowheads have been designated as separate stocks (Moore and Reeves 1993; Cosens *et al.* 1998). Responses of these populations to commercial whaling also support the idea that they represented different groups of whales. The Baffin Bay-Davis Strait whales had already been reduced in number by the time whalers moved into Hudson Bay and found animals in sufficient numbers to support a hunt.

Results of recent analyses of mitochondrial and nuclear DNA genetic markers are consistent with the hypothesis that there are two bowhead populations in the eastern Canadian Arctic. In fact, the Hudson Bay-Foxe Basin population is genetically more similar to the Bering-Chukchi-Beaufort population than to the Baffin Bay-Davis Strait stock, as represented by samples from whales in Cumberland Sound (Maiers *et al.* 1999). There is no genetic information on bowheads summering in the high Arctic, so stock relationships between bowheads in Foxe Basin and the high Arctic and between bowheads in Cumberland Sound and the high Arctic are unknown (DFO 1999).

There is some genetic evidence suggesting that bowheads in northern Foxe Basin and those around Repulse Bay belong to the same population (DFO 1999). Analyses to date have been unable to show a genetic difference between whales sampled in these two summering locations. An aerial photogrammetric study (Cosens and Blouw 1999) has shown that whales summering in northern Foxe Basin are cow-calf pairs and juveniles; thus the adult portion of the population must summer elsewhere. The current hypothesis is that the adult males and resting and pregnant adult females summer in northwestern Hudson Bay around Repulse Bay. Migration routes, outlined in the Inuit Bowhead Knowledge Study (NWMB 2000), suggest that whales occupying these two summering areas are from the same stock.

In Nunavut, many elders and hunters (both active and senior) have stated that when they were children or young adults, they saw bowheads rarely or in small numbers but in recent years or decades they have seen greater numbers (NWMB 2000). This increase has been apparent since the mid-1960s and, more recently, more bowheads are seen on an annual basis. The Inuit Bowhead Knowledge Study (NWMB 2000) also states that *Aujaq* (summer) is the season of maximum extent of open water and the time when bowheads are most widely distributed in the bays, fiords, inlets, and coastal waters of eastern Nunavut (Figure 2).

Hudson Bay-Foxe Basin. This stock is thought to have numbered at least 600 bowhead prior to commercial exploitation in the period 1860-1915 (Reeves and Mitchell 1990). Based on recent aerial surveys, an estimate of 345 bowheads represents the minimum

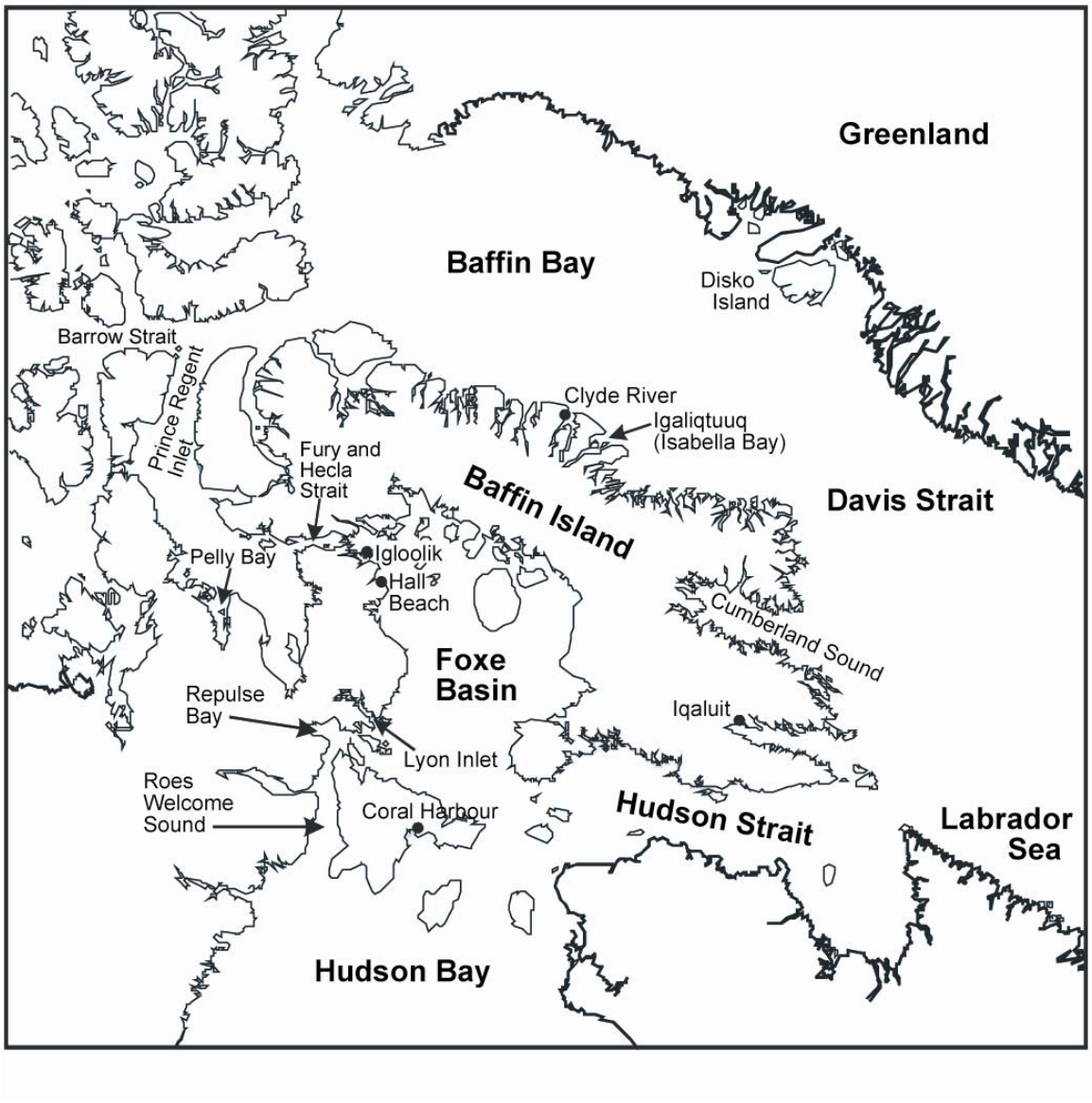

Figure 3. Names of water bodies and communities mentioned in the text

thought to be present in this population (DFO 1999; Cosens and Innes 2000). At least some bowheads may over-winter in Hudson Bay (Reeves and Mitchell 1987).

Bowhead numbers in Northern Foxe Basin and in the Repulse Bay area are higher today than in the 1960s and 1970s, according to comments from elders and hunters who saw bowheads infrequently until more recently when sightings of large groups have become more common (NWMB 2000).

Baffin Bay-Davis Strait. This stock has been estimated to have numbered 12,000 in the year 1825 (Woodby and Botkin 1993), but by the end of the Euro-American whaling it may have been reduced to a few hundred whales (Mitchell and Reeves 1981). Historical counts and estimates from Cape Adair and Isabella Bay areas have been used to produce estimates of 350 (Zeh *et al.* 1993) and 375 bowheads (Cosens *et al*. 1998) respectively. Recent surveys in the wintering grounds off west Greenland indicated that a few tens of whales visited there regularly (Reeves and Heide-Jørgensen 1996). This stock is believed to follow a counterclockwise annual migration pattern following the receding pack ice (Sheldon and Rugh 1995). In the spring, bowheads move from the Labrador Sea across Davis Strait to the west coast of Greenland, and then some likely cross Baffin Bay to the Lancaster Sound area while others continue moving north along the west coast of Greenland for the summer.

Bowheads have been studied as they aggregate in *Igaliqtuuq* (Isabella Bay), along the east coast of Baffin Island in the fall (Finley *et al.* 1998). Results of aerial photogrammetry show that animals aggregating in Isabella Bay are primarily adults; calves and juveniles have rarely been seen in this location (Finley 1990). Summering locations of cow-calf pairs and juveniles are not known. Southern Prince Regent Inlet may be a calf-rearing area.

The Inuit Bowhead Knowledge Study (NWMB 2000) suggests that numbers of bowheads in this stock have increased in all locations. Reeves and Heide-Jørgensen (1996) state that if this stock is increasing in size, it would appear to be doing so mainly in the western part of its range. They analyzed sightings from late winter aerial surveys conducted in the vicinity of Disko Island in the early 1980s and early 1990s and found no evidence for an increase in numbers of bowheads.

2.1.1 Waters in Which Species Occurs

Bowhead whales in eastern Canada are found in Nunavut and Canadian waters during the summer (Figure 1). Aerial surveys conducted in March 1981 suggest that Hudson Bay-Foxe Basin whales may over-winter in northeast Hudson Bay and western Hudson Strait (McLaren and Davis 1982). Thus these whales may occur only in Canadian waters. Bowheads from the Baffin Bay-Davis Strait stock summer in the Canadian high Arctic but may migrate into Greenland waters for the winter. At least some bowheads are found in winter off the west coast of Greenland and one animal, photographed in Isabella Bay, was re-photographed off the coast of Greenland (Heide-Jørgensen and Finley 1991). It is not known what proportion of the population occupies Greenland waters in winter.

2.1.2 Other

Bowheads have a disjunct circumpolar Arctic distribution, north of about 55° N and south of the permanent polar ice cap. Worldwide, there are thought to be five stocks divided by physical barriers such as ice and ocean currents. Within Canadian waters, three stocks or populations are currently recognized (Figure 1), of which two (Hudson Bay-Foxe Basin and Baffin Bay-Davis Strait stocks) are present in the eastern Arctic and one summers in the Beaufort Sea (Bering-Chukchi-Beaufort stock). The other two stocks, as described by Sheldon and Rugh (1995), are the Spitsbergen (east of Greenland to the Barents Sea) and the Okhotsk stock (Okhotsk Sea in eastern Russian waters).

3. Known Breeding Areas

It is believed that breeding takes place in late winter and early spring. Thus, breeding likely occurs in over-wintering areas of the Labrador Sea and Hudson Strait, Baffin Bay, Davis Strait, and west coastal areas of Greenland. The Global Heritage Status rank is G4.

4. Percent of Global Distribution in Canada

This varies seasonally and by stock. It is likely that 100% of the range of the Hudson Bay-Foxe Basin whales is in Canada. In the case of Baffin Bay-Davis Strait whales, up to 100% of the summer range may be in Canada. However, this has not been confirmed. Up to 100 % of the winter range of this population could be in Greenland waters. Historically some bowheads from the Baffin Bay-Davis Strait stock over-wintered along the west coast of Greenland, and currently this is still believed to be the case (Reeves and Heidi-Jørgensen 1996). The proportion of the population that winters off the coast of Greenland is not known.

5. Rate of Population Decline

In the Canadian high Arctic, commercial whaling began in the late 17th century, but did not commence on a regular basis until the early 18th century. At this time, the European whalers were joined by the Americans, and whaling efforts then increased in the waters of Davis Strait and Baffin Bay (DFO 1991). The advent of steam-powered vessels in the 19th century with reinforced hulls enabled whalers to penetrate the ice-clogged waters of Lancaster Sound and Prince Regent Inlet where cow-calf pairs were targeted (de Jong 1983). By the end of the 19th century, commercial whaling had reduced the Baffin Bay-Davis Strait population from an estimated 12,000 whales to possibly several hundred. Commercial whaling began in Hudson Bay in 1860 and by 1915 is thought to have reduced numbers in this stock from about 600 to possibly tens of animals (Woodby and Botkin 1993).

5.1 Commercial Whaling

Commercial whaling in the Canadian eastern Arctic was both a pelagic (open sea) and shore-based activity. In the later years, whaling crews over-wintered with their ships and

hired local Inuit to supply fresh food and to help with over-wintering and bowhead hunting. Within the range of the Davis Strait population, the whaling grounds included Davis Strait, Baffin Bay, and westward among the Arctic islands through Lancaster Sound into Barrow Strait and Prince Regent Inlet. The major whaling was carried out in the 19th century by Europeans and Americans. Ross (1993) estimates that 28,695 bowheads were landed during the 1719-1916 period from the whole range of the population.

In the Hudson Bay population, totally in Canadian waters, small-scale whaling took place mostly in the Marble Island, Roes Welcome Sound, Repulse Bay and Lyon Inlet areas. It was primarily an over-wintering activity dominated by American and Scottish whalers. About 565 bowheads were landed during the 1860-1915 period (Ross 1993). The commercial whaling industry had mostly ended by 1915. Some whaling by Inuit in association with the Hudson Bay Company continued until at least the 1950s (Mitchell and Reeves 1982).

Oil from the blubber and baleen was the mainstay of the Arctic whaling industry but, occasionally, bones were taken on board the whaling vessels. Ross (1993) discusses the changing aspects of the industry – the geography, new industrial replacement products and declining bowhead populations. All bowhead whale populations were depleted by commercial whaling by the early 1900s (Mitchell and Reeves 1982).

5.2 Exploitation

Historically, Inuit hunted bowheads primarily for food and fuel, and secondarily for making items such as snares, traps, baskets, pails, toboggans and drums from the baleen. The commercial whaling industry was centered on the provision of oil (from rendered blubber) and baleen for a host of products such as corsets, hats, umbrella ribs, brushes, sieves, chairs and sofas, and many other uses. To a much lesser degree, bones could be used for fertilizer, arches, gateways and items such as pulley blocks (Ross 1993)

5.2.1 Past Exploitation

The Thule Eskimo culture, which developed in the Bering Sea region about 1,000 years ago, spread eastward across the Canadian Arctic and Greenland. Winter ruins of Thule dwellings contain bowhead bones, which were used in a wide range of products. The regular subsistence harvest of bowheads by Inuit of the Canadian eastern Arctic had mostly ended by 1925, but hunting in association with the Hudson Bay Company continued until at least the 1950s.

5.2.2 Recent Exploitation

Between 1919 and 1981 at least 21 bowheads were landed and ten bowheads were struck and lost in Hudson Bay or Foxe Basin during subsistence hunts. During the same period at least four bowheads were killed and two were struck and lost in other areas of the eastern Canadian Arctic and off Greenland (Cosens *et al.* 1998). Four definite and two

probable additional post-commercial whaling kills of bowheads have been reported by Inuit for northern Hudson Bay since 1919, and one north of Broughton Island (NWMB 2000). The Inuit Bowhead Knowledge Study (NWMB 2000) has revealed 12 new hunts (eight bowhead landed) documented by Inuit that were not found from historical and archival literature by Mitchell and Reeves (1982).

In recent times, Inuit harvested a juvenile (*aktuarjuk*) female in the Igloolik area in1994, an adult male (*akturjuaq*) in the Repulse Bay area in 1996, a juvenile (*aktuarjuk*) male in the Cumberland Sound area in 1998, and a juvenile (*aktuarjuk*) male in the Coral Harbour area in 2000.

6. Potentially Limiting Intrinsic Attributes

Over the last 20 years, it has become increasingly clear that bowheads are long-lived, slow-growing, late-maturing animals. Schell and Saupe (1993) and, more recently, George *et al*. (1999) found evidence to suggest that bowheads become sexually mature at about 20 to 25 years of age. Aerial photogrammetric results suggest that males mature at body lengths of 11.5 to 12.0 meters whereas females mature at a body length of about 13.5 meters (Koski *et al.* 1993). Reproductive rates are thought to be low, with individual females producing one calf about every four years.

Growth of calves during the first three to four years after weaning is thought to be limited because baleen plates are short and feeding efficiency is low (Schell and Saupe 1993). This is likely to be the age class that suffers the highest mortality rate. Most beached carcasses found in the eastern arctic are of young animals, ranging in length from about 7 to 10 meters. In addition, young animals are most likely to be targets of killer whale attacks. In 1999, at least two of four dead calves found near northern Foxe Basin showed evidence of killer whale bites. Sightings of killer whale attacks on juvenile bowheads have also been reported from the east coast of Baffin Island (S. Cosens, pers. comm.).

On the positive side, adult mortality is thought to be very low, not likely more than 1% per year. This, coupled with great longevity, suggests that individual cows could produce a relatively large number of calves during their lifetimes. A cow maturing at 25 and calving every four years for 100 years could produce about 25 calves.

The tendency for bowheads to aggregate in geographically well-defined locations, such as northern Foxe Basin and *Igaliqtuuq* near Clyde River, makes them vulnerable to events occurring in these aggregation areas. Any industrial activity or climatic event that directly affects an aggregation area during a critical time could have a significant impact on a large proportion of a population. Aggregation areas, other than *Igaliqtuuq*, used by Baffin Bay-Davis Strait bowhead whales are not well documented, and thus the potential for catastrophic events to affect this stock is poorly understood. Areas used by the Hudson Bay-Foxe Basin stock are better known and can be monitored. Winter aggregation areas of both stocks need to be identified.

Zeh *et al.* (1995) has estimated that the Bering-Chukchi-Beaufort bowhead population is growing at a rate of about 2% (95% CI = 0.9 to 3.4%) per year. The growth rates of the eastern Canadian populations are not known.

7. Threats

Commercial whaling is no longer a threat to these populations; however, there are extrinsic factors that could limit recovery from depletion by commercial whaling. There was much discussion on this topic at the workshop. The participants rated, as high and low, these potential long-term threats to bowhead recovery (Appendix 4).

7.1 Killer Whales

Inuit often refer to killer whales (*Orcinus orca*) as "wolves of the sea", owing to their habit of attacking, killing, and consuming marine mammals. Killer whales (*aarluit*) are found during the summer in all regions of Nunavut considered by the Inuit Bowhead Knowledge Study (NWMB 2000). This study documented first-hand knowledge and oral tradition of interactions between killer whales and bowheads, including the predation and the effects of killer whales on bowhead behaviour, distribution, and migration. The study further states that bowhead and other marine mammals often exhibit a pronounced fright reaction to the presence of killer whales. This reaction, called *aarlirijuk* in the South Baffin dialect of Inuktitut, involves the movement of marine mammals into areas of broken ice or shallow inshore waters, which may provide some measure of protection from the killer whales. Participants at the workshop indicated that killer whales are possibly the greatest threat to bowhead recovery.

Killer whales may be important predators on bowhead, especially on the young, in the Davis Strait stock. Finley (1990) notes that an estimated 31% of adults in Isabella Bay carry scars and are missing parts. In 1998 and 1999 Inuit in Hall Beach and Igloolik saw more killer whales than usual, and two of four reported dead bowhead found in this area in 1999 may have been wounded by killer whales (P. Simon, pers. comm.). Reeves and Mitchell (1988) state that killer whales are predators on bowhead but that killer whales are not common in Hudson Strait, Hudson Bay, and Foxe Basin. Some Inuit observed fewer visits from killer whales prior to the increase in numbers of bowhead whales dating from the mid-1960s (NWMB 2000). Some also attribute many of the recently found (1999) beached bowheads carcasses (*siluit)* to killer whale predation. They also report that stranded carcasses of bowheads found in the Clyde River area with broken ribs and other broken bones were perhaps killed by killer whales using head blows to the body.

7.2 Ice Entrapment

Ice is an important feature of bowhead habitat but sometimes this close association places bowheads at risk of entrapment in *savsaats*. Generally, Inuit felt that ice entrapments occur infrequently (NWMB 2000). Short of direct mortality due to ice entrapment and ice rafting, there is little doubt that bowheads can be prevented from reaching preferred feeding grounds during heavy ice years (Mitchell and Reeves 1982). Bowhead escaping

from killer whales into heavier ice areas could become trapped. Gray whales occasionally become trapped in early ice, but it is not believed to be a major mortality factor.

7.3 Man-made Noise

The main sources of man-made noise pollution to bowhead today are transportation sounds (ships and aircraft), seismic exploration, marine construction, drilling, subsistence hunting and tourism boats. Bowhead whales are known to react to man-made sources of underwater noise. Most of the research has been done on the Bering-Chukchi-Beaufort whales summering in the Beaufort Sea (Richardson and Malme 1993). Reactions appear to vary by season, habitat and behavioural state. Startle reactions such as hasty dives and avoidance behaviour may occur in response to aircraft. Aircraft flying below 460 meters are more likely to cause reactions than aircraft flying above this altitude (Richardson and Malme 1993).

Bowheads react to vessel traffic by moving away from the ship track. Summering whales have been shown to begin avoidance reactions to vessels at distances of 1 to 4 km. Drillships appear to produce avoidance reactions at distances up to 10 km. Fall migrants appear to react more strongly than summering whales. Similarly, bowheads avoid seismic vessels. Reactions to these vessels have been seen at distances between 6 and 8 km (Richardson and Malme 1993). More recent studies on fall migrants have suggested that avoidance of seismic vessels may begin as far as 20 km from the vessel. Bowheads may be seen in the vicinity of seismic vessels when they are not operating but leave the area once the vessels resume operations (J. Richardson, pers. comm.). In general, there is little scientific information about the cumulative and long-term consequences of repeated or continuous exposure to man-made noises (Richardson and Malme 1993).

Many Inuit participants in the Inuit Bowhead Knowledge Study (NWMB 2000) stated that bowheads do not seem to be adversely affected by canoes or small boats powered by outboard motors, even when hunters are shooting at other species – perhaps because few are presently hunted. Some Inuit believe that bowheads may be disturbed by large vessels; however, they are uncertain about the impact. Some elders do not worry a lot about this as most large ships are necessary for today's Inuit economy (NWMB 2000). Many Inuit also feel that bowhead and other marine mammals are sensitive to land-based and marine explosive (seismic) charges and may avoid areas of such disturbance. Many Inuit (e.g., residents of Clyde River, Pangnirtung) are concerned about the impact of disturbance from tour boats and associated smaller boats attempting to approach whales closely in key areas.

7.4 Pollution / Contaminants

Many hunters fear the negative impact that oil spills may pose for bowheads and other sea mammals and believe that these animals would have to leave the area of an oil spill to survive (NWMB 2000). There is no evidence that any of the large oil spills to date has had a significant impact on a baleen whale population (Geraci and St. Aubin 1990). St. Aubin *et al*. (1984) showed that oil fouling of the haired fringes of baleen reduces feeding

efficiency but that the impact would be short-term if the animal did not remain in the affected area. There is now a rapid increase in offshore oil/gas exploration in Davis Strait/off West Greenland, and Lancaster Sound is known to have some very significant deposits of oil and natural gas (though not yet commercially viable to extract).

Baleen whales generally have lower contaminant concentrations in their tissue than the toothed whales (O'Shea and Brownell 1994). Chemical pollutants are believed to accumulate at relatively low levels due to the low trophic level of bowhead (O'Hara *et al.* 1998). Bratton *et al.* (1993) describe various aspects of contaminant loading in baleen whales, but data and understanding of physiological mechanisms are limited. Available information, although limited, suggests that contaminant exposure poses no present threat to bowheads; however, this needs to be studied and all possible measures should be taken to stop or minimize the release of potentially harmful substances into the environment. Damage by chemical contaminants to planktonic food resources could potentially have an impact on bowhead populations.

7.5 Climate Change

The range of the two bowhead populations in the Canadian Eastern Arctic is characterized by a cold harsh environment in which the presence of ice cover dominates not only the physical accessibility of the habitat but also primary productivity. Annual variability in the extent of ice cover is quite large and related to atmospheric and oceanographic fluctuations. Climate change would affect ice distribution and condition. Long-term climatic changes will likely have a direct and indirect impact on bowhead distribution and abundance. Finley *et al.* (1998) speculate that global warming and climate perturbations are likely to have an impact on future bowhead population growth and distribution. For example, the observation of less ice, more killer whales, and more reported dead bowheads in 1999 in Northern Foxe Basin could be indicative of a significant ecological impact of climate change. Climatic changes are also likely to affect sea surface temperatures, currents, mixing, and other oceanographic phenomena. Such shifts could potentially have major impacts for bowhead distribution, ecology and population levels.

It is not clear that all impacts on bowheads from changes in ice cover would necessarily be negative. For example, an increase in killer whale predation could be counterbalanced by increased copepod production. Changes in bowhead distribution could counterbalance the ability of killer whales to penetrate areas of the arctic currently inaccessible due to ice.

7.6 Fishing Gear Entanglement

If commercial fisheries expand and develop into areas of prime bowhead habitat and migration routes, the use of fishing gear such as gillnets could result in entanglement of bowheads, as is the case for other large baleen whales in other commercial fishery areas. Knowlton and Krause (1998) have shown that entanglement in fishing gear (gillnets and lobster lines) is an important factor in slowing the recovery of the North Atlantic right

whale (closely related to bowhead) population. In the last decade, large-scale marine fisheries for shrimp and turbot have been developing in both the inshore and offshore waters of Nunavut. Off the west and south coasts of Greenland, there are some large commercial fisheries (snow crab, shrimp, Greenland halibut) that could potentially affect bowheads at certain times of year. One case of net entanglement of a bowhead has been reported off the coast of Greenland (Finley 2001).

7.7 Tourism and Recreation

Tourism is increasing in the areas inhabited by bowheads during the summer months. Inuit at Clyde River are concerned about the increasing numbers of large tour ships, and their unregulated operation. The presence of tour boats could potentially have an adverse impact on bowheads feeding in critical areas like *Igaliqtuuq*. An increasing number of motorized boats both from tourism and local recreational activities have the potential to interfere with bowhead activities such as communication, feeding and migration. Increased traffic could also result in collisions, with injury to both whales and humans.

7.8 Diseases and Parasites

There is only limited information on causes of natural illness. What is known has come from the study of apparently normal whales taken in the Alaskan subsistence hunt (Philo *et al.* 1993). Bowheads carry parasites, such as lice, and internal roundworms and tapeworms, and potentially pathogenic microbes (yeasts, bacteria and viruses). They also are known to occasionally suffer from developmental and degenerative conditions.

7.9 Food Competition

Competition from other baleen whales and planktivorous fishes is all but absent in the Arctic marine habitat of summering bowhead whales. Many participants at the 1999 workshop talked about the recent very high numbers of harp seals present during the summer, especially in areas where harp seals were rarely seen in the past. They were concerned about the impact of this on the food chain. Potential competitors for bowhead food include ringed and harp seals, sea birds, and arctic cod, but these and other potential sources of food competition have been little studied.

7.10 Harvest

Participants at the 1999 workshop felt that only the past historical commercial harvest was a significant threat to these populations. Commercial harvest is unlikely to occur in the future. Some participants felt that future subsistence whaling could be higher than at present and that it would not be a threat to bowhead recovery. Since bowheads are continuing to increase in numbers, future subsistence harvests, if set at the right level, would be within safe sustainable levels. The Nunavut Land Claims Agreement sets out principles of conservation (see Appendix 1). In Greenland, the bowhead whale is fully protected, and Greenland aboriginal subsistence hunting focuses on fin and minke whales.

7.11 Non-harvest

Inuit participants at the 1999 workshop felt that the non-harvesting of bowhead whales was a potential threat to the bowhead. They felt that not harvesting bowhead could result in the Inuit having less interest and respect for bowheads and their habitats. A non-harvested species would also probably be a low priority for conservation and research programs.

Some Inuit are concerned about the lack of attention given to bowhead and the erosion of knowledge of bowhead hunting and that this could lead to situations promoting abuse of this animal (NWMB 2000). Some viewed a renewed, ongoing limited hunt as a means of enhancing and restoring concern and respect for, and intimate knowledge about, this species. The Inuit Bowhead Knowledge Study (NWMB 2000) further states that an important belief is that whales would always be available if they were harvested with respect.

The idea of non-harvest being a threat may seem counter-intuitive. However, Freese (2000) discusses at length three important conservation benefits of the consumptive use of wildlife in the arctic:

- it can reduce the desire to develop non-renewable resources that can have a negative impact on wildlife,
- it maintains cultural links with the natural environment,
- it provides products and services that are environmentally less costly than substitutes.

7.12 Other Potential Threats Identified at the 1999 Workshop

a. Scientific Research – A few participants stated that continued research on bowheads concentrated in their summer areas might have a negative impact on their behaviour.

b. Ship Collisions – As the presence of larger vessels for commercial traffic and tourism continue to increase, the potential for ship collisions as a mortality factor for bowheads increases. This is especially relevant as global climate warming continues to melt Arctic ice, and the prospects improve for commercial shipping routes through the NW Passage. Ship collisions are a major cause of mortality for the endangered North Atlantic Right Whale (Knowlton and Krause 1998).

c. Genetic Inbreeding – The genetic diversity of bowheads in the eastern Canadian Arctic has not been estimated. A low genetic diversity (inbreeding depression) could result in reduced fertility, decreased newborn and juvenile survival, or lowered disease resistance (Haebler and Moeller 1993).

The workshop participants independently rated these threats to bowheads in Nunavut as "high" or "low" (Appendix 4). Killer whales, man-made noise, pollution/contaminants,

climate change, non-harvest, and tourism and recreation were rated as high; ice entrapment, subsistence harvest, fishing gear entanglement, diseases and parasites, and food competition were rated as low. Recovery has been slow and it is possible that any number of these threats could impede faster recovery of these populations.

8. Habitat Requirements

Bowheads seem to prefer areas where there is some ice cover and are found near ice edges or floe edges (*sinaa)* but avoid areas where the ice cover is very extensive (NWMB 2000). Certain habitats, such as the ice-edge (Thomas 1999) and deep-water troughs (Finley 1990) are important for feeding. Shallow open-water areas may be used for socializing or for protection from killer whales and high waves (Finley 1990). Breeding and calving requirements are not known. Northern Foxe Basin, where cow-calf pairs and juveniles spend the summer, is relatively shallow and is usually partially covered by pack ice (Thomas 1999). Reeves and Mitchell (1990) state that bowheads are found in a variety of arctic marine habitats such as coastal shallows, deep offshore basins, and areas clear of ice or with extensive ice. Their summer habitat is believed to be largely devoid of competitors; however, the degree of competition by seals for food is not known. They are able to break thick ice (over 20 cm) to breathe and can navigate under extensive ice fields.

Bowheads subsist almost entirely on small invertebrate animals such as copepods (*iglirait*) and euphausiids which are high in energy. They are often observed feeding in size- and sex-segregated groups. Inuit say that bowhead and other marine mammals are strongly influenced by the tidal cycle and tide-induced sea currents (NWMB 2000). The Nunavut Wildlife Management Board further states during *piturniqtuq* (the time around the full moon when tidal variation is greatest) bowhead whales are very active and feed heavily in areas where the currents are strongest.

Bowheads do feed in the spring but seem to rely heavily on the abundant food supply in late summer and fall to store reserves for sustaining themselves during the winter months (Lowry 1993). Thomas (1999) states that in Northern Foxe Basin the dominant behaviour of bowheads, during the ice-edge season (late June and early July), was feeding. Feeding aggregations occur in late summer in shallow continental shelf-like areas such as Isabella Bay (*Igaliqtuuq*) on the east side of Baffin Island where feeding occurs in deep-water troughs. Their summer aggregation areas are influenced by distribution of their prey in productive feeding habitat, and they winter near pack ice, which provides protection from storms (Finley 2001).

8.1 Critical Habitat Safeguards

The impact of pollution and human encroachment on bowhead habitat is not well documented. The annual bowhead cycle involves seasonal migrations to aggregation areas of concentration for various activities such as feeding, breeding and calving. These likely involve habitats such as polynyas, ice-edges, shelf areas, and transit routes that need to be identified and protected. Large proportions of the existing bowhead

populations may be found in very restricted areas for short periods. Thus those areas are of major importance for conservation and recovery. There is a need to protect such critical habitat. The few known critical habitats used by bowheads, such as Isabella Bay (*Igaliqtuuq*), northern Foxe Basin, and the annual coastal migratory routes, need an immediate careful review and full legal protection.

9. Ecological Role

The main ecological roles of bowheads appear to be those of:

- consuming plankton and vertically mixing nutrients,
- keeping ice open for other species,
- making plankton available near the surface for surface feeders like birds (kittiwakes, arctic terns and gulls that make up multi-species feeding assemblages at the ice edge),
- providing a source of energy for scavengers and predators (polar bears, killer whales, arctic fox, humans).

10. Socio-economic Analysis

Bowheads were one of the most important species harvested by Inuit. A renewed harvest would not only provide valuable country food but revive the knowledge of and respect for the bowhead and contribute to the ultimate survival of the species (NWMB 2000). Many Inuit believe that a renewed harvest, with some help and training in order to re-learn how to hunt bowhead successfully, would show respect for elders and could also have positive social and cultural implications for Inuit (NWMB 2000). Elders, in particular, feel that this training would require knowledge, expertise, and advice from the elders and confirm a deep interest and commitment on the part of young hunters and youth.

Bowhead whales are of economic interest to local tour operators and outfitters. Whale watching off Canada's west and east coasts and in other parts of the world has become a major industry and could become more important in the arctic. Documentary film crews and underwater photographers frequent areas used by bowheads and other marine mammals, providing income to local companies which provide boats, guides and camp support.

10.1 Sustainable Inuit Harvest

Many Inuit have stated, given the evidence of present abundance and growth of the bowhead populations, that a limited subsistence hunt is feasible and would still permit continued stock recovery (NWMB 2000). They also state that the bowhead should be carefully and properly managed and that future harvests will require strict control and management.

The Inuit Bowhead Knowledge Study (NWMB 2000) states that a regional-based system of harvesting is generally favoured, with meat and *maktak* from a particular region remaining in that region. Suggested rates of harvest vary from a high of three bowheads per year (one per region) to one every second year.

Before any population data were available for bowheads in Nunavut, the Department of Fisheries and Oceans (DFO) used the estimated hunting rate since the end of commercial whaling to recommend a Total Allowable Harvest that would permit the two stocks to continue to recover. An average of one whale per three years was removed from the Hudson Bay-Foxe Basin population and one whale per 13 years was removed from the Baffin Bay-Davis Strait stock after the end of commercial whaling until 1979, when restrictions were placed on subsistence hunting (Cosens *et al.* 1998). These estimates were the basis for the licensing of subsistence hunts since the signing of the Nunavut Land Claims Agreement. Cosens *et al.* (1998) stated that there should be no increase in these rates of removal until more is known about the population size and stock discreteness.

With new information on numbers and stock relationships from Hudson Bay and Foxe Basin, the Department of Fisheries and Oceans estimated that removing one bowhead every two years from the Hudson Bay-Foxe Basin population (DFO 1999) would still permit recovery. This number was based on Potential Biological Removal (Wade 1998) which estimates annual levels of human-caused mortality that can be sustained by small populations. It is a precautionary approach that uses conservative estimates for stock size and natural mortality and includes a recovery factor that is related to the conservation status of the population. The Department calculated the Potential Biological Removal at the endangered level. It recommends that young animals, rather than reproductively active adults, be taken.

11. Recovery Potential & Rationale

The potential for recovery of the two bowhead populations is high, but recovery will be slow because of their intrinsically low reproductive rates. On a bowhead time scale, population recovery may be occurring at a reasonable rate. The well-studied Bering-Chukchi-Beaufort stock is growing at a rate of 2% per year (Zeh *et al.* 1995), but growth rates of eastern populations have not been estimated.

It is unknown what impact any of the identified potential threats such as predation by killer whales, industrial development, vessel traffic, climate change, and others may have on the recovery rate. Other than killer whale predation, there are, at present, no obvious sources of significant mortality on these stocks. At the present time, risks to bowheads in Canada from ship strikes and fishing gear entanglement are negligible. There is no significant industrial activity in eastern Canadian arctic waters. Only one gear entanglement off the coast of Greenland (Finley 2001) has ever been reported. The degree to which killer whale predation may be reducing stock recovery should be evaluated. The degree to which vessel traffic and industrial and other activities might be affecting bowheads in Greenland waters should also be evaluated.

Calf production that has been documented in northern Foxe Basin appears to be variable from year to year but substantial in some years. Relatively large numbers of juveniles have been observed in this area. Much work needs to be done to locate calf-rearing areas used by the Baffin Bay-Davis Strait whales to assess the rate of calf production in that stock.

12. Recommended Scale for Recovery Action

Since the bowhead is a very long-lived species that reproduces slowly, a long time frame of 100 years is recommended for this recovery strategy. Recovery actions must be coordinated and implemented fully across the entire historical range, including both Canadian and Greenland waters.

13. Knowledge Gaps

The scientific knowledge is currently inadequate to evaluate the status of the Baffin Bay-Davis Strait stock or to estimate recovery rates of either stock. Long term approaches to estimating population parameters and monitoring the impact of human activities have been identified (Table 1). Several research programs that address these information needs are currently in progress (Table 2).

Virtually all estimates of life history parameters discussed in this document are based on scientific studies conducted over the past thirty years on the Bering-Chukchi-Beaufort bowhead stock (Burns *et al.* 1993). There is some information on mortality from the eastern arctic stocks which has been collected from the examination of beached carcasses. However, there is currently no information on calving rates, age at first reproduction, or longevity. Data from aerial photogrammetry in northern Foxe Basin suggest that body lengths of females seen with calves are similar to those described from studies done in the Beaufort Sea; however, it is not known whether growth rates are comparable between the two stocks. Most life history parameters of Bering-Chukchi-Beaufort whales have been estimated from hunter-killed animals, taken in Alaska. It is unlikely that the sampling effort in Nunavut can be high enough to develop such estimates specifically for the eastern arctic stocks.

The research approaches outlined in Table 1 will enable estimates of stock sizes and recovery rates to be developed for each of the eastern stocks. Critical habitats will be identified and stock relationships will be described. With this information, stock status can be determined and monitored and population trajectories can be modelled. This information will also be the basis for advice to fisheries managers on the levels of subsistence hunting that will permit stocks to recover. It should also be possible to assess the degree to which stocks have recovered from depletion by comparing current estimates of numbers with those of the bowhead thought to have been remaining after the end of commercial whaling. This is currently being done for the Hudson Bay-Foxe Basin stock.

Ongoing scientific and traditional knowledge studies (Table 2) directly address questions about stock status, stock structure, distribution and movements, and the impact of human activities. Satellite telemetry projects are being carried out in cooperation with the Greenland Research Institute (GRI). Tagging of bowheads by GRI in the spring of 2001 near Disko Island is providing valuable information that can be used by the Recovery Implementation Team to plan future research and monitoring projects for Baffin Bay-Davis Strait whales. GRI personnel have also provided training to the Department of Fisheries and Oceans. Tagging activities to be conducted in northern Foxe Basin and Pelly Bay, beginning in 2001, will provide valuable information on stock boundaries and distribution. Biopsy sampling and genetic analyses are continuing to provide information on stock structure and genetic diversity. Aerial surveys in southern Prince Regent Inlet will assess whether this area is a significant calf rearing location. Monitoring of bowhead numbers and oceanographic features in *Igaliqtuuq* will provide ongoing information on a critical feeding area used by migrating adults. Funding for ongoing projects has been acquired from several sources, including the Department of Fisheries and Oceans, Nunavut Wildlife Management Board, World Wildlife Fund (Canada), Environment Canada, and a number of Nunavut partner organizations.

Table 1. Long-term research and monitoring plan for conservation of bowheads in the Canadian eastern Arctic. Approaches will incorporate both scientific and traditional knowledge.

Information Needed	Research and Monitoring Approach
Stock status	Use aerial surveys and other methods, as appropriate, to estimate and monitor numbers every 5 to 10 years. Monitor factors that may inhibit population recovery or cause changes in distribution. Develop population models to assess current recovery rates and predict future population trends.
Stock structure	Use genetic, photographic and other methods to describe and monitor stock relationships, and age class and gender segregation patterns.
Distribution and movements	Use tagging, photographic, sighting records and other methods to monitor distribution patterns and collect information on migratory routes.
Impacts of human activities	Monitor vessel traffic and other noise-generating activities in sensitive bowhead habitat. Assess all industrial and other proposals that may have an impact on sensitive bowhead habitats. Establish and monitor sustainable harvest levels for Inuit. Use remote sensing, tagging, traditional and local knowledge and other methods to monitor the impact of climate change on ice cover, primary productivity, and killer whale and bowhead distribution and activity.
Critical Habitat	Identify habitat features of important areas used by bowheads.

Table 2. Ongoing research and recovery activities that address long-term goals identified in Table 1. As projects are completed, results will be reviewed and needs for additional information will be evaluated by the Recovery Team.

Information Required	Activity	Anticipated Time Frame
Stock status	Complete second estimate of numbers in northern Foxe Basin and northwestern Hudson Bay.	2002-2003
	Estimate numbers aggregating in southern Prince Regent Inlet.	2000-2003
	Estimate numbers in Baffin Bay-Davis Strait stock.	2003-2004
	Complete model of population recovery scenario for Hudson Bay-Foxe Basin.	2001-2004
Stock structure	Continue biopsy sampling of skin from free-ranging whales for genetic analysis.	1995-2005
	Apply satellite-linked tags to identify stock boundaries.	2001-2004
	Describe age classes of whales aggregating in southern Prince Regent Inlet.	2001-2005
Distribution and movements	Apply satellite-linked tags to describe movements and relate locations to habitat features.	2001-2004
	Complete historical analysis of age classes taken by commercial fishery in northwestern Hudson Bay.	2000-2002
Impacts of human activities	At *Igaliqtuuq*, assess the impact of ship-based tourism on bowhead behaviour at feeding aggregations.	ongoing
	Estimate genetic diversity of both stocks.	1995-2006
Critical habitat	Monitor critical habitat at *Igaliqtuuq*.	2001-2004

IV. RECOVERY

14. Recovery Goal

Bowhead whales are slow growing, long-lived, and reproduce relatively slowly; therefore, population recovery will take a long time. Research, monitoring and protection of bowheads and their habitat, and monitoring of population recovery rates must span a long timeframe to effectively promote and measure recovery. A time frame of 100 years is being recommended for this Conservation Strategy. Within this long time frame, shorter plans spanning five-year periods will be designed, implemented, evaluated and modified as required. This Conservation Strategy includes a recovery strategy, which will meet national legislation and guidelines. Goals and objectives were developed primarily through discussions held at the stakeholder workshop in Iqaluit in 1999.

Recovery Goal:
To promote population recovery and maintain self-sustaining and healthy bowhead whale populations in Nunavut.

15. Short-term Recovery Objectives

Objective 1: Identify and protect important areas used by bowhead whales.

Actions:
- conduct full surveys of all the range to identify key habitats
- produce a map of all critical bowhead habitats
- flag critical bowhead habitats in all resource, land-use, coastal zone and offshore planning
- develop area management plans with local communities
- protect these key areas from potentially detrimental impacts

Objective 2: Establish a long-term monitoring and research program combining both traditional knowledge and science.

Actions:
- document existing population and ecological information and identify key information gaps
- develop a prioritized plan to fill the information gaps
- design a monitoring system with special focus on local community involvement
- ensure sustained funding to fully complete these programs

Objective 3: Ensure a sound, sustainable and continuing Inuit subsistence harvest of bowhead whales.

Actions:
- determine Inuit needs for subsistence harvest from a cultural perspective
- determine bowhead population levels and sustainable levels of harvest

- develop a community-based monitoring program for all harvests
- develop communication material on the subsistence harvest

Objective 4: Ensure that human activities do not adversely affect bowhead whales or their habitat.

Actions:
- identify and describe the current activities potentially threatening bowhead
- develop and carry-out plans to monitor effects of threats
- establish and adhere to policies and procedures for planning of industrial development programs
- establish and apply firm guidelines for approval and implementation of new developments, and link closely with co-management boards
- establish regulations and enforcement programs to ensure compliance

Objective 5: Communicate clearly this conservation initiative to the public in Nunavut and beyond.

Actions:
- produce communication materials for use in the communities and agencies of Nunavut
- produce communication material for public use outside of Nunavut

16. Recommended Approaches

Most of the activities under Objectives 1 & 2 would be carried out in the short-term (five to ten years). Most of the activities under Goals 3 & 4 would be more of an ongoing and long-term nature. Activities under Goal 5 would continue throughout the duration of the implementation of this conservation strategy.

Tables 3 and 4 outline, for Objectives 1 & 2, examples of some of the approaches that may be taken by the Recovery Team to design their annual work plans.

Table 3. Objective 1: Identify and protect important areas used by bowhead whales.

Action	Priority	Anticipated Effect	Cost ($K)
Map key habitat areas	high	Support planning for research and industrial development	5
Identify key areas for resource-use planning	high	Minimize impact on bowhead habitat	----
Develop area management plans	high	Involve local communities	500
Legally protect key areas	high	Minimize impact on critical habitat	300

Table 4. Objective 2: Establish a long-term monitoring and research program combining both traditional knowledge and science.

Action	Priority	Anticipated Effect	Cost ($K)
Document information and identify gaps	high	Assist decision-making and planning for marine areas	25
Develop plan to fill gaps	high	Focus research activities	10
Design monitoring system with communities	high	Involve local communities in planning	25
Conduct research	high	Develop information upon which to base land use planning and hunt management	400+

17. Actions Already Completed or Underway

Objective 1: Identify and protect important areas used by bowhead whales.

Action: Protect key areas from potentially detrimental impacts.

1. *Igaliqtuuq*

   The process for protection of bowhead habitat is in progress through the proposed *Igaliqtuuq* Bowhead Conservation Plan. A habitat stewardship program is being developed for *Igaliqtuuq*, to run from 2001-04.

2. Impact Review

   In a broader context, habitat is protected by the impact review process where all proposals are assessed for impacts on bowhead habitat.

Objective 2: Establish a long-term monitoring and research program combining both traditional knowledge and science.

Action: Document existing population and ecological information and identify key information gaps.

1. COSEWIC (Committee on the Status of Endangered Wildlife in Canada) Status

   The status of eastern Canadian Arctic bowheads is currently under review and an update is expected in 2002.

2. Scientific Research

   Department of Fisheries and Oceans (DFO) scientific research on stock relationships, movements and distribution is ongoing. Species at Risk funding is now available for bowhead whale research. Nunavut Wildlife Management Board and DFO continue to fund bowhead research. Communities are involved in planning and data collection.

3. Stock Status Reports

   DFO Science published a Stock Status Report for Hudson Bay-Foxe Basin Bowhead Whales in 1999.

4. Inuit Bowhead Knowledge Study

   The NWMB completed and published the Inuit Bowhead Knowledge Study in 2000. Results of this study were incorporated into the DFO Stock Status Report.

Objective 3: Ensure a sound, sustainable and continuing Inuit subsistence harvest of bowhead whales.

Action: Determine bowhead population levels and sustainable levels of harvest.

1. Population Estimates

   For the Hudson Bay-Foxe Basin stock, numbers of bowheads using summering areas have been estimated from aerial surveys.

2. Sustainable Levels of Harvest

For the Hudson Bay-Foxe Basin stock, a Potential Biological Removal of one whale every two years has been calculated. This is the estimated number of whales that can be removed from the stock through human-induced mortality without compromising stock recovery.

Action: Develop communication material on the subsistence harvest

1. Management Plan

   The DFO/NWMB Bowhead Management Plan is updated in years when a hunt is planned.

Objective 4: Ensure that human activities do not adversely affect bowhead whales or their habitat.

1. Environmental Sailing Directions

   The Canadian Coast Guard has developed the Environmental Sailing Directions as a guide for ship captains sailing through environmentally sensitive areas in arctic waters. It includes maps of areas where marine mammals may be present and provides guidelines about vessel operation in these areas.

   These sailing directions were used in 1999 when the CCGS Louis S. St-Laurent sailed through Fury and Hecla Strait in early July. At this time, bowheads with calves are in the melt-holes of the fast ice in Northern Foxe Basin and concerns were raised by Department of Fisheries and Oceans about the effect on calf survival of a ship passage at this time. The ship captain used the sailing directions, along with additional detailed information about the likely distribution of whales in the ice, to guide the vessel through the Strait. On-board personnel used aircraft to confirm bowhead distribution and allow selection of a route to minimize disturbance to the whales.

18. Action Plan Development

The Recovery Team will meet every two years to review ongoing research and stewardship activities. Recommendations for future directions will be made at that time.

19. Anticipated Conflicts or Logistical Difficulties

At least some bowheads from the Baffin Bay-Davis Strait stock over-winter in Greenland waters; therefore, it is important that recovery activities be coordinated with Greenland. Coordination of tagging research is underway. Results of tagging and genetic research on this stock will be used to evaluate the degree to which Greenland should be involved in land-use planning within Canada. Canada may wish to become involved in land-use planning in Greenland should activities there have an impact on bowheads that summer in Nunavut.

There is conflict between the International Whaling Commission (IWC) and Canada over whether Canada should be licensing subsistence hunts. DFO personnel regularly report research findings to the IWC. Although this does not address political concerns, presentation of research results does show that Canada is conducting a significant level of research in support of recovery and management of bowhead stocks.

The large geographical range and remoteness of areas occupied by eastern arctic stocks result in high costs for monitoring and research. Variability in the degree of ice cover and weather conditions are significant logistical challenges to implementing work plans based on aircraft or boat travel. Even the process of holding meetings of the Recovery Team will be expensive and time-consuming. Stakeholder involvement adds further costs because meeting participants must travel either from or to remote communities.

20. Potential Management Impacts for other Species / Ecological Process

At the present time, it appears to be unlikely that recovery actions will have significant detrimental affects on non-target species. Killer whales are likely to be positively affected. As bowhead populations recover, killer whale numbers will likely increase. It is possible that an increase in killer whale numbers could affect other prey species such as narwhals. There is insufficient information available to predict effects; consequently, numbers and activities of killer whales should be monitored to determine whether their numbers and predation rates on narwhals, belugas and seals increase. Such changes, if they were to occur, could be indicative of a re-balancing of ecological relationships that would have been disrupted by commercial whaling. Management intervention in these predator-prey relationships is not anticipated.

21. Record of Consultation / Key Lands / Associated Contacts

Eastern Canadian Arctic bowheads occur in both Canadian federal offshore and Nunavut territorial inshore waters as well as in international and Greenland waters. The Department of Fisheries and Oceans, under the Oceans Act and the Fisheries Act, is responsible for management of and collection of information on marine habitats in Canada. The Nunavut Planning Commission and Nunavut Wildlife Management Board are responsible for land use planning and wildlife management respectively in Nunavut waters.

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Consultation activities included regular telephone conferences among members of the Advisory Committee and a workshop to incorporate stakeholder input into the plan. The workshop was held in Iqaluit on 16-17 December, 1999.

Table 5. Participants at 1999 Iqaluit workshop to develop conservation plan for eastern Canadian Arctic bowhead whales.

Participant	Affiliation	Location
Joanasie Akumalik	Executive Director, QWB*	Iqaluit
David Alagalak	Member, NWMB	Arviat
Louie Bruce	Hunter	Coral Harbour
Peter Ewins	Director, Arctic Program, WWF	Toronto
Keith Hay	IBKS Staff, NWMB	Iqaluit
Burt Hunt	Area Director, DFO	Iqaluit
Joannie Ikkidluak	Chairman, QWB	Kimmirut
Peter Kooniliusie	Elder, Hunter	Clyde River
Moses Koonoo	Member, NWMB	Arctic Bay
Ben Kovic	Chairman, NWMB	Iqaluit
Meeka Mike	Member, NWMB	Iqaluit
Robert Moshenko**	Consultant	Winnipeg
Cornelius Nutarak	Elder, Hunter	Pond Inlet
Bruno Qavvik	Hunter	Kugaaruk
Pierre Richard	Biologist, DFO	Winnipeg
Lynn Siegersma	Land Claim Liason Officer, DFO	Iqaluit
Patrice Simon	Biologist, DFO	Iqaluit
Mariano Uqqarqluk	Executive Member, KHTA	Kugaaruk
Michelle Wheatley	Director, Wildlife Management, NWMB	Iqaluit
Glenn Williams	Wildlife Advisor, NTI	Iqaluit

*Abbreviations: DFO – Department of Fisheries and Oceans
IBKS – Inuit Bowhead Knowledge Study
KHTA – Kitikmeot Hunters and Trappers Association
NTI – Nunavut Tunngavik Incorporated
NWMB – Nunavut Wildlife Management Board
QWB – Qikiqtaaluk Wildlife Board
WWF – World Wildlife Fund

** Principal coordinator and writer

Workshop Interpreter: Mary Nashook

External reviewers were contacted to review drafts of the conservation plan. They are identified in the Acknowledgements section.

22. Evaluation

Performance measures of the success of the conservation plan include the following:

Stock Status:

1. Population trends based on survey estimates show an increase in bowhead numbers over time.
2. Population recovery model for Hudson Bay-Foxe Basin stock completed.
3. Sightings of bowheads by Inuit continue to show an increase in numbers of whales.

Stock Structure:

1. Stock relationships confirmed.
2. Calf-rearing areas identified through tagging, sightings and photographic surveys.

Distribution and Movements:

1. Location of migration routes and summer aggregation areas confirmed.
2. Movement between Canada and Greenland confirmed.

Impacts of Human Activities:

1. Shipping controls maintained to minimize disturbance of bowheads.
2. Guidelines for non-consumptive use of bowheads (e.g., whalewatching) will be developed.
3. Continued harvest does not pose a conservation concern.

Critical Habitat:

1. Critical habitats will be identified and protected.

23. Lead Organizations Responsible for Species Recovery

Principal Organizations: Nunavut Wildlife Management Board, Department of Fisheries and Oceans, World Wildlife Fund

Inuit Organizations: Regional Wildlife Organizations (Kivalliq Wildlife Board, Kitikmeot Hunters and Trappers Association, Qikiqtaaluk Wildlife Board), local Hunter and Trapper Organizations, Nunavut Tunngavik Inc.

Other Partners: Environment Canada, Parks Canada, Transport Canada, Nunavut Government (DSD)

24. Recovery Team Members and Associated Specialists

The recovery team has not yet been named but members will include specialists from the Department of Fisheries and Oceans, World Wildlife Fund, Nunavut Wildlife Management Board, the three Regional Wildlife Boards, Nunavut Tunngavik Inc., and other interested parties.

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26. Prepared by

The Canadian Eastern Arctic Bowhead Advisory Committee

27. Date Completed

September 2001

28. Appendices

Appendix 1. Nunavut Land Claims Agreement and Bowhead

The Nunavut Land Claims Agreement (NLCA) is protected under section 35 of the Canadian Constitution. The NCLA came into force on 09 July 1993.

Article 5 of the NCLA deals with wildlife and provides for the establishment of the Nunavut Wildlife Management Board (NWMB). The NWMB serves as the main instrument of wildlife management in the Nunavut Settlement Area (NSA). The Board is an institution of public government and is made up of eight members as well as a chairperson. Article 5 also sets out the make-up, powers, duties, and responsibilities of the NWMB, including its obligation to operate under the principles of conservation.

Article 5.1.5 of the NLCA states the principles of conservation:

(a) the maintenance of the natural balance of ecological systems within the Nunavut Settlement Area;
(b) the protection of wildlife habitat;
(c) the maintenance of vital, healthy, wildlife populations capable of sustaining harvesting needs as defined in this Article; and
(d) the restoration and revitalization of depleted populations of wildlife and wildlife habitat.

Article 5.6.18 of the NLCA states that the NWMB shall establish a total allowable harvest by Inuit in the NSA of at least one bowhead and thereafter, the total allowable harvest (TAH) shall be dealt with by the NWMB from time to time. The NWMB, in keeping with the terms of the NLCA, established a total allowable harvest of one bowhead for the NSA for 1996, one for 1998 and one for 2000. The NWMB's decision for the TAH was based on both the traditional ecological knowledge as well as scientific data collected by the Department of Fisheries and Oceans (DFO). Both sources of information indicated that bowhead stocks in the eastern Arctic have increased enough to allow for a low-level bowhead hunt. In 1996, 1998 and 2000, the Minister of Fisheries and Oceans, accepted the NWMB's allocation as per the NLCA and licenced the hunts.

Appendix 2. Inuit Bowhead Knowledge Study

Through the NLCA, Inuit have indicated a strong interest in resuming a limited harvest of bowhead in the NSA and the NLCA affirms the traditional and cultural importance of the bowhead to Inuit of Nunavut. Article 5 of the NLCA requires the NWMB to carry out a five year Inuit Bowhead Knowledge Study (IBKS) in the NSA. The purpose of this IBKS was to document Inuit knowledge of bowheads in Nunavut, including the relative abundance and distribution of bowheads and changes in these parameters since the cessation of commercial whaling, in about 1915 (Aglukark and Hay 1996). The IBKS began in March 1995 and was published in March 2000.

The IBKS was the primary source of traditional knowledge used in the development of the Conservation Strategy. This information was integrated in a complementary fashion with scientific information.

Appendix 3. Advisory Committee

The members of the Canadian Eastern Arctic Bowhead Advisory Group were:

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Appendix 4. Potential Threats to Bowhead Whales

Table 6. The number of workshop participants who ranked their perceived severity of future potential threats to bowhead whales as either high or low. The overall rating was based on the level of severity selected by the majority of workshop participants.

Threat	Number of participants		Overall Rating
	High	Low	
Killer whales	15	1	high
Ice entrapment	0	13	low
Man-made noise	10	5	high
Pollution and contaminants	12	3	high
Climate change	9	5	high
Subsistence harvest	4	10	low
Non-harvest	15	0	high
Fishing gear entanglement	2	13	low
Tourism and recreation	10	5	high
Diseases and parasites	5	10	low
Food competition	0	14	low

Appendix 5. Current and Future Protective Measures

In 1950, the International Whaling Commission (IWC), under their regulations, banned the killing of bowhead whales, except for aboriginal subsistence use.

In 1951, Canada ratified the *Whaling Convention Act* and, in 1952, enacted the *Whaling Regulations*. The killing of bowheads was prohibited, with the exception of hunting for local consumption.

In 1972, Canada banned commercial whaling in its waters.

In 1977, the IWC banned all aboriginal subsistence whaling except in Alaskan waters for the Inupiat hunt.

In 1979, the Canadian federal *Cetacean Protection Regulations* banned the hunting of bowheads without a licence.

In 1982, Canada, no longer a commercial whaling nation, withdrew its membership from the IWC. Canada, subsequently, repealed its *Whale Convention Act* and the *Whaling Convention Regulations* (SI/82-130). *Cetacean Protection Regulations* were promulgated under the *Fisheries Act* (S.0.R./ 82-614).

In 1993, several regulations pertaining to the management of various marine mammals made under the *Fisheries Act* were consolidated into the *Marine Mammal Regulations*. Under these regulations, a licence is required to hunt bowheads.

The *Oceans Act* of 1998 gives the Department of Fisheries and Oceans the responsibility and jurisdiction to protect the marine environment, to regulate scientific research, and to control offshore installations. This Act also gives the Minister the lead role in the development of a national oceans strategy based on principles of sustainable development and integrated management of activities in estuaries, coastal and marine waters. This Act is the instrument for the implementation of Marine Protected Areas.

The bowhead whale is listed on Appendix l of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), meaning that trade in bowhead products is strictly regulated. For example, carvings made by Inuit from old bowhead bone or baleen can be exported from Canada only if accompanied by appropriate CITES Import and Export Permits.

Bowhead whales in the Canadian eastern Arctic were listed as Endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 1980 (Campbell 1984; Cook and Muir 1984) and 1986 (Campbell 1988). This designation is being reviewed by COSEWIC.

The *Species at Risk Act* is the primary statutory instrument for the assessment, classification, recovery, and overall protection of species at risk, including bowhead whales. Among the features of the Act is the requirement for the relevant Minister to develop a strategy for the recovery of each wildlife species listed by the Federal Government as endangered or threatened. The Minister must also prepare one or more Action Plans based on the Recovery Strategy. Finally, if a species is listed as a species of special concern, the relevant Minister must prepare a comprehensive Management Plan for the species and its habitat. All Recovery Strategies, Action Plans and Management Plans applying within the Nunavut Settlement Area must be prepared in accordance with the provisions of the NCLA and in cooperation with the NWMB.